WHAT IS CLAIMED IS:

1. Device for determining at least a left ventricular end diastolic volume LVEDV for a heartbeat of a beating heart of a mammal, in particular a human being, having a body having a thorax, the device comprising

- a current source for producing an alternating current with a frequency
- one or more upper supply electrodes and one or more lower supply electrodes, which can be applied to said body of said mammal and which can be connected to said current source, for supplying said alternating current to said body,
- one or more upper measuring electrodes and one or more lower measuring electrodes, which can be applied to said body of said mammal above said heart, below said heart, respectively, for receiving an impedance signal that depends on the impedance of a part of said thorax at least comprising said heart,
- measuring means, connected to the measuring electrodes, for measuring said impedance signal which is received by the measuring electrodes,
- a processing unit, connected to said measuring means, for processing and outputting at least a value of said impedance signal and a first time derivative of said impedance signal,

wherein the device further comprises means for determining a duration DFT of a diastolic filling time of said heart during said heartbeat and for determining a value of said impedance signal at the end of a pre-ejection period of said heart during said heartbeat, which diastolic filling time and pre-ejection period may be determined in a manner known per se, and wherein said processing unit is designed for determining and outputting said value of said left ventricular end diastolic volume LVEDV in dependence of both said duration DFT and said value of said impedance signal and the difference of said value of said first time derivative of said impedance signal between the beginning and the end of said pre-ejection period.

2. Device according to claim 1, wherein the means for determining said duration DFT comprise an electronic circuit, which is able to determine said duration DFT as the time between the moment at which said first time derivative assumes a third local minimum value following a maximum value during said heartbeat, and the moment at

which said first time derivative assumes a local minimum value immediately before the next maximum value.

3. Device according to claim 1, wherein said means for determining said duration DFT are sound recording means which are able to determine said duration DFT as the time between the beginning of the second component of the heartsound following a maximum value of said first time derivative during said heartbeat and the beginning of the next heartsound.

4. Device according to claim 1, in which said processing unit outputs said left ventricular end diastolic volume LVEDV as

$$LVEDV = C \cdot \left(\frac{L}{M_0}\right)^2 \cdot DFT \cdot \Delta \frac{dZ_M}{dt}$$, wherein

C = a predetermined constant in Ohm.cm,
L = the shortest distance between said one or more upper measuring electrodes and said one or more lower measuring electrodes in cm, when the device is being used,
M_0 = basic myocardial impedance in Ohm,
DFT = said duration of said diastolic filling time of said heartbeat in seconds, and
$\Delta \frac{dZ_M}{dt}$ = is said difference of said value of said first time derivative of said impedance signal between the beginning and the end of said pre-ejection period of said heartbeat of said heart in Ohm/s, wherein the equation
M_0 = factor $\cdot$ Z_0 holds, wherein
Z_0 = is the value of said impedance signal at the end of said pre-ejection period, and
factor = a number with a value of 0.54 ± 0.02.

5. Device according to claim 4, wherein C equals the resistivity of the blood of said mammal at the frequency of the applied alternating current.

6. Device according to claim 1, wherein the processing unit further can output the ejection fraction EF as

$$\mathrm{EF} = \frac{\mathrm{SV}}{\mathrm{LVEDV}},$$ wherein,

SV = the instantaneous stroke volume of said heart, as determined in a manner known per se, and

LVEDV = said left ventricular end diastolic volume.

7. Device according to claim 1, wherein each of the measuring electrodes and/or the supply electrodes have been chosen from the group consisting of strip electrodes and spot electrodes.

8. Method for determining at least a left ventricular end diastolic volume LVEDV for a heartbeat of an intermittently contracting heart of a mammal, in particular a human being, having a body having a neck and having a thorax having a sternum, comprising the following steps

- applying to said body one or more upper measuring electrodes, one or more lower measuring electrodes, one or more upper supply electrodes and one or more lower supply electrodes, such that said heart is completely between each of said one or more upper measuring electrodes and each of said lower measuring electrodes and such that each of said measuring electrodes is between said one or more upper supply electrodes and said one or more lower supply electrodes,
- supplying an electrical alternating current with a frequency by means of a current source which is connected to said upper supply electrodes and said lower supply electrodes,
- receiving an impedance signal which depends on an impedance of a part of said thorax, which part at least comprises said heart, by means of said one or more lower measuring electrodes and said one or more upper measuring electrodes,
- measuring at least a value of said impedance signal by means of measuring means, and
- determining a value of a first time derivative of said impedance signal,

wherein the method further comprises the step of determining a duration DFT of a diastolic filling time for said heartbeat, and wherein said value of said left ventricular end diastolic volume LVEDV is determined as

$$LVEDV = C \cdot \left(\frac{L}{M_0}\right)^2 \cdot DFT \cdot \Delta \frac{dZ_M}{dt}$$

wherein

C = a predetermined constant in Ohm.cm,

L = the shortest distance between said one or more upper measuring electrodes and said one or more lower measuring electrodes in cm,

M_0 = basic myocardial impedance in Ohm,

DFT = said duration of said diastolic filling time for said heartbeat in seconds, and

$\Delta\frac{dZ_M}{dt}$ = is said difference of said value of said first time derivative of said impedance signal between the beginning and the end of a pre-ejection period of said heartbeat of said heart, in Ohm/s, which pre-ejection period is determined in a manner known per se, wherein the equation

M_0 = factor $\cdot$ Z_0 holds, wherein

Z_0 = is the value of said impedance signal at the end of said pre-ejection period of said heartbeat of said heart, and

factor = a number with a value equal to 0.54 ± 0.02.

9. Method according to claim 8, wherein said duration DFT is determined as the time between the moment at which said first time derivative assumes a third local minimum value following a maximum value during said heartbeat, and the moment at which said first time derivative assumes a minimum value immediately before the maximum value of the next heartbeat.

10. Method according to claim 8, wherein said duration DFT is determined by measuring heartsounds of said heart with the help of additional sound recording means, wherein said duration DFT is determined as the time between the beginning of the second component of said heartsound following a maximum value of said first time derivative for said heartbeat, and the beginning of the next heartsound.

11. Method according to claim 8, wherein said one or more upper measuring electrodes are applied to the mid neck region and said one or more lower measuring electrodes are applied at the height of the xiphoid junction of said sternum.

12. Method according to claim 8, wherein said constant C is the resistivity of the blood of said mammal at the frequency of said applied alternating current.

13. Method according to claim 12, wherein said resistivity may be determined from the hematocrit value Hct of a sample of said blood of said mammal, using the formula $\rho = 53.2 \cdot e^{0.022 \cdot Hct}$.

14. Method according to claim 8, wherein further an ejection fraction EF is determined as

$$EF = \frac{SV}{LVEDV},$$ wherein

SV = the instantaneous stroke volume for said heartbeat, which volume is determined in a manner known per se, and

LVDEV = said left ventricular end diastolic volume.

15. Method according to claim 8, wherein at least one value chosen from the group consisting of left ventricular end diastolic volume LVEDV and ejection fraction EF, is determined only when the value of said impedance signal Z_0 substantially equals the average value of at least 5, and preferably at least 10 preceding values of said impedance signal Z_0.